Developing a serious game to graphically depict the COVID-19 period in South Africa

NM Hadebe
28131606

Research proposal submitted for ITRI671

Supervisor: Dr. J.T. Janse van Rensburg

Date of submission: 24 May 2020
Version: 2

TABLE OF CONTENTS

LIST OF TABLES

RESEARCH PROPOSAL

1 Introduction

Recently, the world has been battling a coronavirus pandemic named COVID-19. Coronaviruses are a massive phylum of viruses that can contaminate the respiratory tract and cause various diseases that ranges from a cold to serious diseases namely, Severe Acute Respiratory Syndrome(SARS) and Middle East Respiratory Syndrome(MERS) (WHO, 2020a).

This research will focus on the COVID-19 period in South Africa and how the virus has impacted the country. The goal of this research is to develop an educational serious game that will depict the impact of COVID-19 in South Africa.

A serious game can be defined as a game that is not only for entertainment purposes, but that also serves as an educational medium (Susi *et al.*, 2007:1). This game will serve to educate players about the coronavirus and preserve the information for future generations.

In the next section, the background of the research will be discussed. Section 3 will highlight the research statement, while Section 4 provides an overview of the key concepts of the research. In Section 5 the research aim and objectives are introduced and discussed. The research approach is introduced in Section 6. Section 7 discusses the research rigour, validity, and reliability. The research ethical considerations are discussed in Section 9. The closing section of this chapter is the executive summary which provides a summary of the research.

2 Background to study

In December 2019, Wuhan in China was plagued by a disease that attacked the body causing pneumonia, this pandemic originated in China and has now infected over 2 million people with over 200 thousand fatalities worldwide (Matt & Weiss, 2020). On the 11th of March 2020, the World Health Organisation (WHO) declared that the coronavirus was a pandemic (Matt & Weiss, 2020).

Countries needed to devise a plan on how to keep their nation safe and contain any infections detected. The reasoning behind this study is to create a graphical game that will educate the people of South Africa about how the coronavirus impacted the country. This study will also aim to preserve information regarding this historic event for future generations.

3 Problem statement

According to the World Health Organisation, there is a coronavirus pandemic affecting the world (WHO, 2020a). In an attempt to address this pandemic, the WHO institute released multiple press stories and instructional guidelines to follow to protect oneself against being infected with the disease.

The National Institute for Communicable Disease (NICD) released guidelines that the public should follow to stay safe during this pandemic. The NICD urges the public to practice hand hygiene, proper couch etiquette, and avoid close contact with people suffering from any acute respiratory infections, and to avoid visiting any shops or markets where live animals are sold (NICD, 2020a).

The Centers for Disease Control and Prevention (CDC) states that if one wants to protect themselves from this virus they should wash their hands often and if soap or water is not available it might be better to use a hand-sanitiser that contains alcohol, and avoid any urge to touch your eyes, nose and mouth without washing your hands, and frequently touched surfaces need to be cleaned and disinfected (NICD, 2020a).

While the information is helpful and provides a sufficient overview of everything a person needs to know, some individuals respond better to visual instructions. If the information can be presented in a visual and interactive manner, there could be an increase in understanding of the pandemic and a reduction in the local transmission of the virus.

Morudu (2020) states that because South Africa had been servery affected by both the HIV and the Spanish flu pandemics, the government has taken history in account and to help curb the coronavirus, robust health responses were launched. Morudu further states that the novel coronavirus pandemic is the third pandemic of this kind of this sort to ever hit the southern tip of Africa in more 100 years. The Spanish Flue claimed about 50 million lives internationally and South Africa had the fourth highest fatality rate, and the AIDS-related illnesses took about 2.8 million lives between 1997 and 2010.

On the 23rd of March, the president of South Africa announced that there would be a countrywide lockdown implemented as a way to restrict the transmission of the virus (Ramaphosa, 2020b).

After the national announcement, the president deployed the South African Defence Force and the South African Police Service to enforce the lockdown restrictions. The SADF and SAPS have made multiple arrests, and on the 28th of April, it was reported by the Sowetan that the police

arrested three individuals posing as COVID-19 health officials who had fake permits attempting to cross the border to collect cannabis (Pijoos, 2020).

According to Insider (2020), South African retail stores have begun experimenting with measures that support social distancing and sanitation measures. When in the payment queues, customers need to stand about 1.5 to 2 meters from another customer.

During the lockdown period, various things have been happening and South Africans are not used to this type of environment. It will be a period of South African history that will be remembered and this study aims to both educate people on how to protect themselves, as well as for the game to be used by future generations as a source of information that graphically depicts what happened during this period.

For this reason, the study proposes to develop a serious game to graphically depict what happened in South Africa regarding COVID-19.

Research questions that inform the study:

- What information related to COVID-19 in South Africa will need to be portrayed in the game?
- How can design science research be used to guide the development of a serious game?
- Which tool will be an appropriate platform to build a serious game?
- How will a learning experience be measured when playing the game?

4 Key concepts of the study

This section assists in explanations of the key concepts of this study.

4.1 Coronavirus

According to Chen *et al.* (2020:507), a coronavirus is a virus that affects the acute respiratory system. The National Foundation for Infectious Diseases defines coronavirus as a large family of viruses that can cause illnesses that range from mild respiratory infections such as common cold to much more serious illnesses like pneumonia or Severe Acute Respiratory Syndrome (NFID, 2020). The first coronavirus was discovered in chickens in the 1930s and after a few years, the first human coronavirus was identified in the 1960s (Broadbent, 2020).

According to WHO (2020b), another coronavirus (SARS-CoV) was identified in 2003. It first infected humans in the province of Guangdong in Southern China in the year of 2002. The epidemic affected more than 23 countries with over 8000 cases. SARS is an influenza-like illness that sometimes leads to progressively severe respiratory insufficiency. The transmission of this virus was primarily through person to person contact. The symptoms of this illness include fever, malaise, myalgia, headache, diarrhea, and shivering. WHO also establishes that most of the infections occurred in the health care setting because of the absence of adequate infection control precautions.

According to the Centers for Disease Control and Prevention (CDC, 2015), the MERS-CoV was first reported in Saudi Arabia in September 2012, but the outbreak started in April 2012 in Jordan. WHO confirmed there are 956 laboratory-confirmed cases and 351 fatalities. The cases were directly or indirectly linked through traveling to the following places: Saudi Arabia, the United Arab Emirates, Qatar, Jordan, Oman, Kuwait, Yemen, Lebanon, and Iran. The most recent form of a coronavirus is the COVID-19 disease.

4.2 COVID-19

COVID-19 is an infectious disease that is caused by the recently discovered coronavirus. The National Institute of Communicable Disease NICD (2020b) states that most of the case-patients identified worked and have visited the seafood poultry and live wildlife market in Hubei Province. The institute suggests that there is a possibility that the novel coronavirus originates from animals that occasionally carry harmful germs that cause illnesses when they are ingested by humans.

The foundation also states that the virus is more severe and at higher risk to older adults and people that suffer from any chronic medical conditions which include heart disease, lung disease, diabetes, cancer, and hypertension (NFID, 2020).

Matt and Weiss (2020) explain that the COVID-19 pandemic originated in China and has now infected over 2 million people with over 200 thousand fatalities worldwide. Over 212 countries and territories have now been infected with this virus and Italy and the United States of America and Spain leading to the number of infections and fatalities.

According to Kaplan (2020), as the coronavirus continues to spread, some countries have started to implement lockdown to protect their citizens. South Africa, France, Italy, India, New Zealand, Poland, and the United Kingdom have executed the biggest and most prohibitive mass quarantines.

The number of new infections in Italy, France, and Spain has begun to fall, and these countries have now begun the process of easing the lockdown restrictions. Spain's lockdown started on the 14th of March and the citizens can only leave their houses to visits the supermarkets, pharmacies, or medical facilities. The lockdown will only be lifted in the second half of May (Brandon, 2020).

The country Italy has also promised to lift its restrictions that began on the 9th of March. Prime Minister Guiseppe stated that on the 4th of May factories may open but with strict social distancing protocols. Restaurants may also serve takeaways and citizens can visits relatives and take walks outside as long as they wear face marks and follow social distancing guidelines (Brandon, 2020).

The rates of COVID-19 in South Africa has increased to the 10 000 mark since the president announced on the 15th and 16th of March. The next section will give an overview of COVID-19 in South Africa.

4.3 COVID-19 in South Africa

On the 23rd of March 2020, the South African president, Cyril Ramaphosa, announced that South Africa will be going into total lockdown from the 26th of March 2020 (Ramaphosa, 2020b). Restrictions were put upon the country to restrict that no more than 100 people could attend gatherings, and schools were closed. No individual could leave their house except under strictly controlled situations, such as buying essential products, seeking medical care, or collecting a social grant. The number of cases on the 23rd of March was 402 and the number has kept increasing daily since then.

According to Singh (2020), a local non-governmental organisation (NGO) applied to the apex court to argue that the country's lockdown is not the right move because the country is not facing an emergency due to the COVID-19. The NGO argued that the virus is not harmful to Africans and that the virus is a 'self-healing' disease to Africans. The apex court dismissed the application stating that the NGO was misinterpreting scientific findings and pushing misguided political and ideological ends.

On April 9th the minister of health, Dr. Zweli Mkhize, opened a nation briefing about the steps that needed to be taken to prevent the spread of COVID-19. Prof Abdool Karim gave a brief about where South Africa was at this point. The nation briefing highlighted that the country's shutdown was step 3 and if there was a decline in the number of infections then the country would move into step 4 - which is surveillance and active case finding and includes door-to-door screening (Dr Zweli Mkhize, 2020).

Since the 26th the country has been under lockdown and on the 9th of April President Cyril Ramaphosa made a nation announcement indicating that the lockdown will continue until the 30th of April 2020. Ramaphosa (2020a) stated that since the lockdown had started on the 27th of March the number of infections was standing on 1,170 and on the 9th of April the number of infections was at 1,934. The numbers showed an average daily increase of the infections was around 4% since the lockdown started.

The government has developed a three-part strategy that aims to firstly, run multiple tests on the public to slow down the spread, and secondly, offer monetary support measures to help organisations and individuals affected by the pandemic. Thirdly, build a program that can increase social support to ensure that poor and vulnerable households are protected.

While there is a lot of raw information available on the COVID-19 period in South Africa, the qualitative data is distributed among many sources. One way to consolidate the information is to create a serious game that serves both as an educational tool on preventive measures, as well as a summary of valuable information for future generations.

4.4 Serious Games

Michael and Chen (2005:18) state that a game is an activity among two or more adversaries seeking to achieve their objectives within existing rules. They also state that the problem with the above definition is that not all games need to be a competition between two or more opponents. Some games require players to work together to achieve a common goal. Harteveld and Bekebrede (2011:44) states that single player games are created with a certain instructional message or goal in mind such as improving an organisation or teaching.

According to Susi *et al.* (2007:3), the core definition of serious games is digital games that are not only used for entertainment but also educational purposes.

Serious games that are education-specific are most likely to be effective and convey knowledge to people (Catalano *et al.*, 2014:1). Catalano *et al.* (2014:4) also state that for the game to be effective the developer needs to consider certain practices. It also mentions pedagogically driven design and how it can better improve the development and the design of a serious game.

Rebolledo-Mendez *et al.* (2009:21) evaluated the societal impact of a simulation-based serious game. A game FloodSim was developed and provided to individuals to play and provide feedback on how the game was and if it was able to raise any awareness of floods. The results gathered based on the feedback received from the players suggest that a large number of players had

positive things to say about the FloodSim. Players who didn't have any significant knowledge about floods found FloodSim very educational and lastly the players acknowledged that FloodSim raised awareness of flooding at a basic level.

5 Research aim and objectives

According to Pate (2018), a research aim is defined as a statement that the research hopes to accomplish. In this section, the research aim and the research objectives are identified.

5.1 Research aim

The research aims to develop an educational-based serious game about the impact of COVID-19 in South Africa. This game will educate the public about the impact of the coronavirus and provide visual guidelines to protect themselves against COVID-19. The game will also serve as a platform to preserve information for future generations.

5.2 Research objectives

According to Dudovskiy (2019) research objectives are all the accomplishments that a researcher wishes to achieve within the time frame of the research and they also provide the direction a study can take

5.2.1 Primary Objective

To develop an educational-based serious game that depicts the COVID-19 period in South Africa using graphic techniques and visual style design.

5.2.2 Secondary Objectives

Secondary objectives can be divided into theoretical and empirical objectives.

5.2.2.1 Theoretical objectives

- To understand the impact that COVID-19 has on South Africa.
- To research the benefits of an educational serious game.
- To create a shared understanding of design science research and how it can be used to guide the development of the artefact.

5.2.2.2 Empirical objectives

- To create an effective data gathering tool in the form of an online questionnaire for pre- and post-tests.
- To gather the quantitative data and complete data analysis to reveal meaning in the data through descriptive statistics.
- To develop an educational serious game using graphical and visual style design elements.

6 Research approach

Quantitative research is used to express numbers and graphs. This approach will be used to express the participant's scores before and after playing the game. To gather the scores surveys, questionnaires will be used, and each participant will need to complete the pre and post-testing of the game. The questionnaires and the survey will be open-ended questions.

M.K. (2020) states that descriptive statistics takes the data that has been collected and reports what it is and what it shows. M.K. (2020) further explains that descriptive statistics is usually used with quantitative data and converts it to be easily understandable.

Descriptive analysis has three characteristics used to analyse data namely: the distribution, the central tendency, and the dispersion. With the distribution each one variable will be analysed in the data, the central tendency is used to calculate the mean, median, mode (M.K., 2020).

Descriptive analysis can be used to analyse the data gathered, which includes collecting, exploring, and presenting data to discover underlying patterns and trends in player's scores which can explain if the players were able to learn something from the game.

6.1 Research methodology

Design science research methodology allows for the development and evaluation of various information technology products that are created to solve different organisational problems (Peffers *et al.*, 2007:77). This methodology gives specific guidelines for assessment and iteration within research projects.

Hevner *et al.* (2004:76) define design science research as creating products that interpret any ideas, practices, technical capabilities through several development phases. These phases are analysis, design, implementation, and management.

Hevner and Chatterjee (2010:11) further state that the design science methodology is deeply rooted in engineering and above all, it is a problem-solving paradigm.

Hevner *et al.* (2004:78) explain that design science is both a product and a process. This view on design science supports the problem-solving paradigm that repeatedly moves between the design process and designed artefacts.

The focus of the research is on the development of a serious game artefact which makes design science research a suitable research methodology and paradigm for this research.

6.2 Selection of participants

This section will discuss the selection of participants.

6.2.1.1 Sampling size and technique

The number of respondents to take part in this study will be determined by the type of data gathering and analysis methods. For quantitative data and descriptive statistics, a minimum of 30 respondents should be used based on the central limit theorem (Ganti, 2019).

6.2.1.2 Inclusion criteria

The respondents that will be included in the study will be South African adults. Prior knowledge of the COVID-19 disease does not impact whether individuals can participate in the study or not.

6.2.1.3 Exclusion criteria

The individuals that will be excluded from this study are children and teenagers. Children and teenagers will be excluded because they need permission from their guardians and raise additional ethical concerns further discussed in Section 8.

6.3 Recruitment of participants

The respondents will be recruited using electronic forms of communication. The respondents may receive an email with an internet link detailing what the research is about. The respondent will read the summary of the research and will indicate their participation by completing the included data gathering tool.

6.4 Process of obtaining informed consent

Informed consent is an agreement that the respondent's sign to permit the researcher to use their data after reading the full information about the possible effects or results (Cambrigde Dictionary, 2020a).

During the recruiting of participants, the respondents will also receive an email that contains an internet link to a form that fully explains what the research is about, the type of data to be collected and how will it be collected. When the respondent fully understands what the research is about and if they are interested, they can give their consent or choose not to participate.

6.5 Data collection

This section explains the data collection method and the development of the data collection tool.

6.5.1 Data collection method

Quantitative data collection methods are often used because they provide valuable numeric data. The data gathering tool for this research will be online questionnaires. The online questionnaires will gather data using pre and post-testing. At the end of each form, there will be limited open-ended questions (one or two) that will collect design feedback in the form of qualitative data.

Merriam-Webster Dictionary (2020c) defines pretesting as testing an individual's or students' knowledge to evaluate their knowledge about a certain topic.

Post-test can be defined as a test that is given to students or participants after completing a certain activity or program to evaluate their achievements and the effectiveness of the program, usually used hand in hand with pre-testing (Merriam-Webster Dictionary, 2020b).

Pre- and post-testing methods will be used to measure whether learning took place. Several questions will be created based on the content of the game, and the respondents will answer the questions before and after playing the game. The scores will be collected and stored.

The pre- and post-testing methods enable the quantification of the scores into graphs, percentages, and infographics to better explain the score the players received when they started playing the game and the rate in which the players increased their score after playing the game after several times (Auraria-Library, 2019) .

6.5.1.1 Development of data collection tool

Online questionnaires allow the researcher to assign numbers to the respondent answer which will then be converted into numerical data (Ainsworth, 2020). The online questionnaire will be developed using Google forms. The pre- and post-tests will be in an online format and respondents will be asked questions that relate to the COVID-19 period in South Africa.

The usage of online questionnaires enables the researcher to view the data in real-time and create graphs at any moment. The online questionnaires can increase the productivity of researchers and saves time (Smart Survey, 2020).

The online questionnaire will include questions about the coronavirus that will be answered before and after playing the game. Open-ended questions will be included to gather the design feedback and where improvements can be made.

7 Rigour / Validity & reliability

Design science research has seven guidelines that provide effective research (Hevner *et al.*, 2004). Table 1 provides an overview of these guidelines.

Table 1: Design Science Guidelines (Hevner *et al.*, 2004:86)

Guideline	Description
Guideline 1: Design as an Artefact	Design science research must produce a feasible artefact in the form of a construct, a model, a method, or an instantiation.
Guideline 2: Problem Relevance	The objective of design science research is to create technology-based solutions to fundamental and relevant business problems
Guideline 3: Design Evaluation	The utility, quality, and efficiency of a design artefact must be rigorously demonstrated via a well-executed evaluation method.
Guideline 4: Research Contributions	Effective design-science research must provide clear and verifiable contributions in the areas of the design artefact, design foundation, and or design methodologies.
Guideline 5: Research Rigor	Design-Science research relies upon the application of rigorous methods in both the construction and evaluation of design artefacts.

Guideline 6: Design as a Search Process	The search for an effective artefact requires utilising available means to reach desired ends while satisfying laws in the problem environment.
Guideline 7: Communication of Research	Design-science research must be presented effectively both to technology-oriented as well as management-oriented audiences.

Based on the guidelines the product of the research is to produce a technological-based viable artefact that will provide solutions to an existing business problem. To establish that the design of an artefact is efficient, has good quality and is usable, evaluation methods will be created, and the artefact will be judged on those methods as set out in the previous sections.

Hevner *et al.* (2004:87) state that in design science research must contribute either the design artefact, foundations, and methodologies. When performing this research, it must contribute to the before mentioned aspects.

Research rigor evaluates the success of the research based on the researcher's skilled selection of techniques that are appropriate to develop and build an artefact or theory (Hevner *et al.*, 2004:88). To perform research rigor, methods need to be developed in order to determine how well the artefact works, why the artefact works or does not work, and make new improvements to the artefact.

8 Ethical considerations

Connelly (2014) states that when conducting research, there are a few ethical considerations that a researcher needs to follow:

- Consent should be given voluntarily, the respondents should understand what the research is about.
- Respondents should be able to withdraw from the research when they want to.
- No group of people may be included or excluded from the research unless there is a valid reason to do so.
- Recruitment methods for the research must not use coercion, the respondent must voluntarily want to participate in the research.
- Any conflict of interest that arises should be reported and addressed.

- Findings need to be reported honestly and clearly, with no deception to people reading the paper.

Shaw *et al.* (2011:29) state that when conducting research that involves respondents under the age of 16, certain ethical considerations need to be followed namely:

- When a respondent is under the age of 16, consent is required from the parent as well as the child. The researcher needs to receive consent at the start of the research, the start of the data collection, consent for the usage of the collected data, and consent throughout the process of data collection.
- The researcher needs to keep in mind the possible effects that the research study might have on a child. The researcher needs to avoid causing harm to the child by avoiding focus groups or questionnaires if the study topic is sensitive.
- The children's confidentiality needs to be maintained throughout the research. The researcher needs to explain the limitations of the confidentiality and the limitations of the storage methods to the respondent and their guardian.
- The researcher needs to ensure that they are never alone with a child in buildings when conducting interviews.

For these reasons we won't be using children in this research because children are very vulnerable, and they need special attention when conducting research.

To strengthen the ethical considerations the research will need to complete the code of conduct from the institution where the research takes place, as well as follow the necessary process for ethical clearance (North-West University, 2020).

9 Executive Summary

The world has been hit with a pandemic named the coronavirus. Countries needed to devise a plan on how to keep their nation safe and contain any infections detected. The reasoning behind this study is to create a graphical game that will educate the people of South Africa about how the coronavirus impacted the country and preserve information for future generations.

The key concepts that are applicable to this study are: coronaviruses, COVID-19, COVID-19 in South Africa, and serious games. The primary and secondary objectives were identified, the secondary objective was divided onto theoretical and empirical objectives. Quantitative research will be used to gather data.

Quantitative research will express the participant's scores that will be gathered before and after playing the game. The participants' scores will be gathered using online questionnaires for pre- and post-testing. Descriptive analysis of the data gathered will be used to discover underlying patterns and trends in player's scores to distinguish if respondents learned something from the game. The respondents to be included in this research are South African adults and prior knowledge of the COVID-19 disease does not impact whether individuals can participate in the study or not. Children and teenagers will be excluded from this study.

The methodology to be used to support this study is design science methodology. Design science methodology can be explained as the development of an artefact to solve organisational problems. The study aims to make a contribution to the DSR paradigm through the development of a novel artefact that addresses a current issue experienced worldwide.

REFERENCES

Ainsworth, Q. 2020. Data Collection Methods. https://www.jotform.com/data-collection-methods/ Date of access: 24 April 2020.

Auraria-Library. 2019. Data Visualization: Quantitative vs. Qualitative. https://guides.auraria.edu/c.php?g=528873&p=3964258 Date of access: 13 May 2020.

Brandon, S. 2020. Three of the world's hardest-hit nations are preparing to end their lockdowns. https://www.weforum.org/agenda/2020/04/three-of-the-worlds-hardest-hit-nations-are-preparing-to-end-their-lockdowns Date of access: 01 May 2020.

Broadbent, L. 2020. Coronaviruses – a brief history. https://theconversation.com/coronaviruses-a-brief-history-135506 Date of access: 11 May 2020.

Catalano, C.E., Luccini, A.M. & Mortara, M. 2014. Guidelines for an effective design of serious games. *International Journal of Serious Games*, 1(1).

CDC. 2015. Update on the Epidemiology of Middle East Respiratory Syndrome Coronavirus (MERS-CoV) Infection, and Guidance for the Public, Clinicians, and Public Health Authorities — January 2015. https://www.cdc.gov/mmwr/preview/mmwrhtml/mm6403a4.htm Date of access: 01 May 2020.

Chen, N., Zhou, M., Dong, X., Qu, J., Gong, F., Han, Y., Qiu, Y., Wang, J., Liu, Y. & Wei, Y. 2020. Epidemiological and clinical characteristics of 99 cases of 2019 novel coronavirus pneumonia in Wuhan, China: a descriptive study. *The Lancet*, 395(10223):507-513.

Connelly, L.M. 2014. Ethical Considerations in Research Studies. *MEDSURG Nursing*, 23(1):54-55.

Dictionary, C. 2020a. informed consent. https://dictionary.cambridge.org/dictionary/english/informed-consent Date of access: 13 May 2020.

Dictionary, M.-W. 2020b. Posttest. https://www.merriam-webster.com/dictionary/posttest Date of access: 24 April 2020 2020.

Dictionary, M.-W. 2020c. Pretest. https://www.merriam-webster.com/dictionary/pretest#examples Date of access: 13 May 2020.

Dr Zweli Mkhize, P.A.K., Nonhlanhla Yende-Zuma,Cheryl Baxter ,Tulio D'Olivera,Yogan Pillay,Anban Pillay. 2020. SA's COVID-19 epidemic: Trends & Next steps (pp. https://sacoronavirus.co.za): Department of Health.

Dudovskiy, J. 2019. Formulating Research Aims and Objectives. https://research-methodology.net/research-methodology/research-aims-and-objectives/ Date of access: 01 May 2020.

Ganti, A. 2019. Central Limit Theorem (CLT). https://www.investopedia.com/terms/c/central_limit_theorem.asp Date of access: 11 May 2020.

Harteveld, C. & Bekebrede, G. 2011. Learning in Single-Versus Multiplayer Games: The More the Merrier? *Simulation & Gaming*, 42(1):43-63.

Hevner, A. & Chatterjee, S. 2010. Design science research in information systems. Design research in information systems. Springer. p. 9-22).

Hevner, A.R., March, S.T., Park, J. & Ram, S. 2004. Design science in information systems research. *MIS quarterly*:75-105.

Insider, B. 2020. SA retailers are trying social-distance queuing systems – with mixed results so far. https://www.businessinsider.co.za/social-distancing-queuing-systems-at-south-african-stores-2020-3 Date of access: 30 April 2020.

Kaplan, J. 2020. At least 20% of the global population is on coronavirus lockdown – here are their rules. https://www.businessinsider.co.za/countries-on-lockdown-coronavirus-italy-2020-3?r=US&IR=T Date of access: 01 May 2020.

M.K., P.W. 2020. Descriptive Statistics. https://conjointly.com/kb/descriptive-statistics/ Date of access: 13 May 2020.

Matt & Weiss. 2020. How coronavirus started and what happens next, explained. https://www.wired.co.uk/article/china-coronavirus Date of access: 24 April 2020.

Michael, D.R. & Chen, S.L. 2005. Serious games: Games that educate, train, and inform: Muska & Lipman/Premier-Trade.

Morudu, P. 2020. This is South Africa's third major pandemic in 100 years. It has learned its lessons. https://www.washingtonpost.com/opinions/2020/05/01/this-is-south-africas-third-major-pandemic-100-years-it-has-learned-its-lessons/ Date of access: 02 May 2020.

NFID. 2020. Common Questions and Answers About COVID-19 for Older Adults and People with Chronic Health Conditions. https://www.nfid.org/infectious-diseases/common-questions-and-answers-about-covid-19-for-older-adults-and-people-with-chronic-health-conditions/ Date of access: 01 May 2020.

NICD. 2020a. COVID-19 PREVENTION. https://www.nicd.ac.za/diseases-a-z-index/covid-19/covid-19-prevention/ Date of access: 30 April 2020.

NICD. 2020b. FREQUENTLY ASKED QUESTIONS. https://www.nicd.ac.za/diseases-a-z-index/covid-19/frequently-asked-questions/ Date of access: 01 May 2020.

Pate, E. 2018. Aims and Objectives of a Research Proposal. https://classroom.synonym.com/aims-objectives-research-proposal-4168.html Date of access: 22 April 2020.

Peffers, K., Tuunanen, T., Rothenberger, M.A. & Chatterjee, S. 2007. A Design Science Research Methodology for Information Systems Research. *Journal of Management Information Systems*, 24(3):45-77.

Pijoos, I. 2020. Suspects use Covid-19 branding to cross borders to collect dagga. *TimesLive*.

Ramaphosa, P.C. 2020a. President Cyril Ramaphosa: Extension of Coronavirus COVID-19 lockdown to the end of April. https://www.gov.za/speeches/president-cyril-ramaphosa-extension-coronavirus-covid-19-lockdown-end-april-9-apr-2020-0000 Date of access: 01 May 2020.

Ramaphosa, P.C. 2020b. Statement by President Cyril Ramaphosa on escalation of measures to combat the Covid-19 epidemic. http://www.thepresidency.gov.za/speeches/statement-president-cyril-ramaphosa-escalation-measures-combat-covid-19-epidemic%2C-union Date of access: 2020 2020.

Rebolledo-Mendez, G., Avramides, K., de Freitas, S. & Memarzia, K. 2009. Societal impact of a serious game on raising public awareness: the case of FloodSim. *Proceedings of the 2009 ACM SIGGRAPH symposium on video games*:15-22.

Shaw, C., Brady, L.-M. & Davey, C. 2011. Guidelines for research with children and young people. *London: National Children's Bureau*.

Singh, J. 2020. COVID-19: Science and global health governance under attack. *South African Medical Journal*, 110(5).

Survey, S. 2020. 10 Advantages of Online Surveys. https://www.smartsurvey.co.uk/articles/10-advantages-of-online-surveys Date of access: 10 May 2020.

Susi, T., Johannesson, M. & Backlund, P. 2007. Serious games: An overview: Institutionen för kommunikation och information.

University, N.-W. 2020. RESEARCH ETHICS POLICY. http://www.nwu.ac.za/content/policy_rules Date of access: 13 May 2020.

WHO. 2020a. Q&A on coronaviruses (COVID-19). https://www.who.int/news-room/q-a-detail/q-a-coronaviruses Date of access: 25 April 2020.

WHO. 2020b. SARS (Severe Acute Respiratory Syndrome). https://www.who.int/ith/diseases/sars/en/ Date of access: 01 May 2020.